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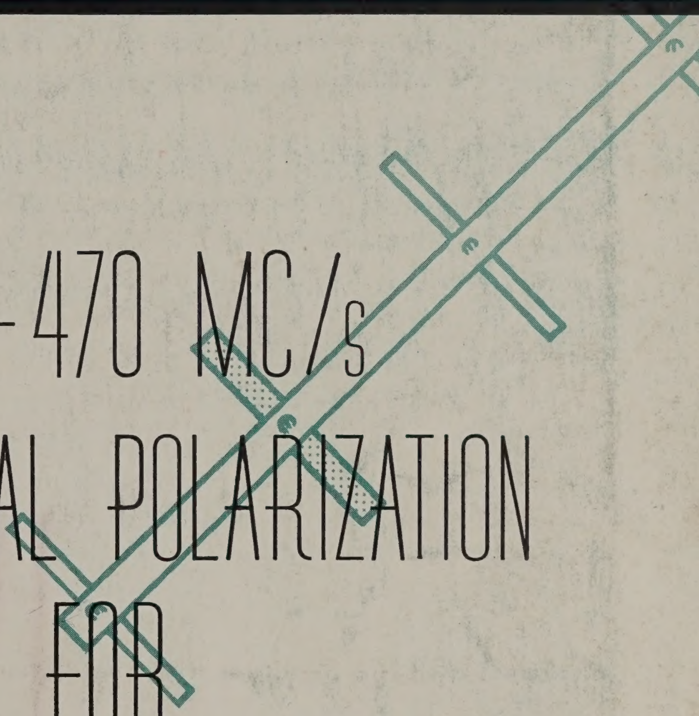

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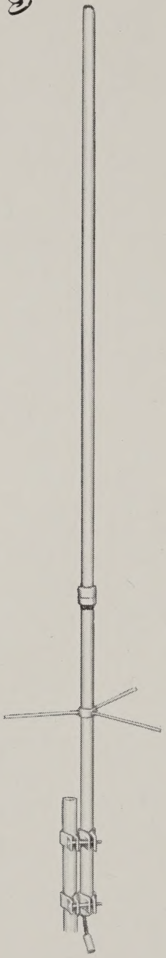

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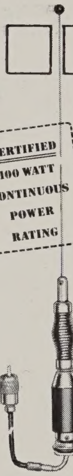

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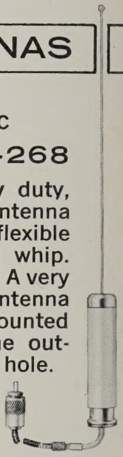

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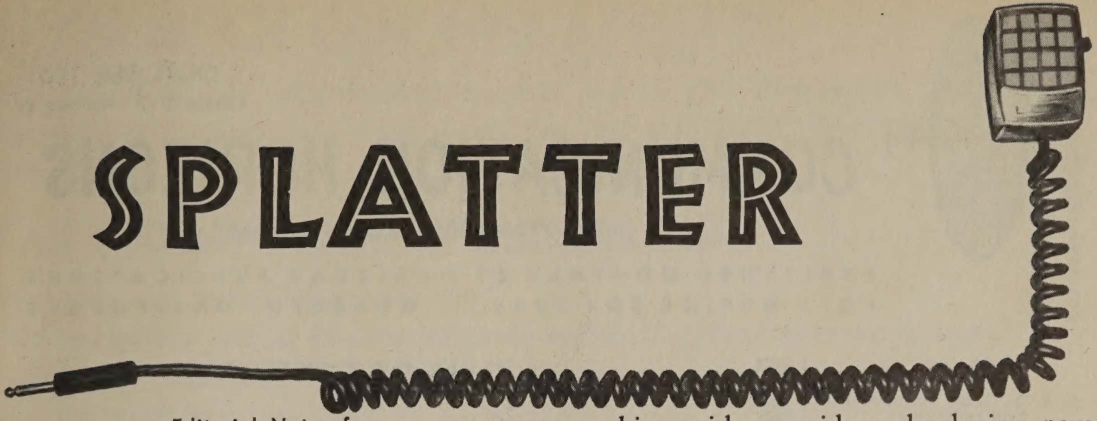

SPLATTER

Editorial Notes from
Communication Horizons Editor
Robert B. Cooper, Jr. K6EDX

More About SY-PEP

In the August 1961 issue of this publication this writer discussed the SY-PEP program. For the new reader, SY-PEP is the abbreviated form of *Communications Industry Engineering Paper Evaluation Project,* a program designed to bring into print in this publication the very best and latest professional communications ideas this industry has to offer.

SY-PEP is sponsored by Communications Horizons and Horizons Publications with cash awards to the best papers submitted in each of five categories during four-three month contest periods encompassing the remainder of 1961 and a part of 1962. As a reminder, the categories include the following broad headings:

(1) Communications Systems — Theoretical

(1b) Communications Systems — Practical and Reports

(2) Equipment Development — Theoretical

(2b) Equipment Development — Practical and Reports

(3) Industry — Timely

This month's Communication Horizons contains three SY-PEP papers, submitted by personnel from the HY-Gain Antenna Company, The Andrew Company, and Prodelin, Incorporated. Other papers on hand are in the process of preparation for appearance in the November and December issues of Communication Horizons.

The point is simply this. If your communications firm (whether you are a manufacturer, installer or engineer) is working with new ideas, developing new and better methods of communications in the VHF and UHF regions, then you are a candidate to prepare a paper for the SY-PEP program. A SY-PEP paper appearing in Communication Horizons is not only excellent public relations for your company, it is an excellent way to build the company image with the two-way communications field.

Finally, papers which appear in print and/or are judged "best of the category" for a project period (the first period ended September 15, and the best papers will be announced in the November issue) automatically earn for their writers capital rewards in the form of hard-cold author's checks from Horizons Publications. The best paper of the year, in all categories, will be eligible to earn $500 for its author! What better reason to sit down now and begin drafting your own entry for the SY-PEP program? The complete details were spelled out in this column for August . . so dig up your copy and fire away. SY-PEP is underway!

Making The Rounds

One of the more interesting patterns of growth here at Communication Horizons is the way subscriptions have taken hold. Communication Horizons is the "professional communications magazine," by and for VHF, UHF and microwave communications people. Whether your firm is large or small, there is a subscription program tailored to save you money at the same time guaranteeing that your employees stay up-to-date with the very latest in communications news. Direct your inquiries to *Circulation Department, Communication Horizons, P. O. Box 3206, Modesto, California.*

OCTOBER 1961
Volume 1 • Number 5

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and "Two-Way Radio Digest"

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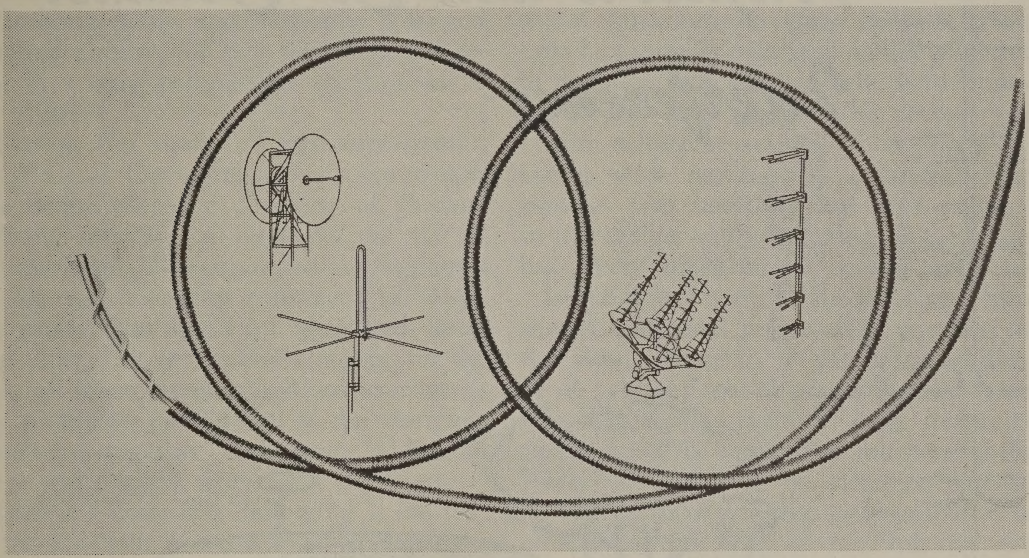

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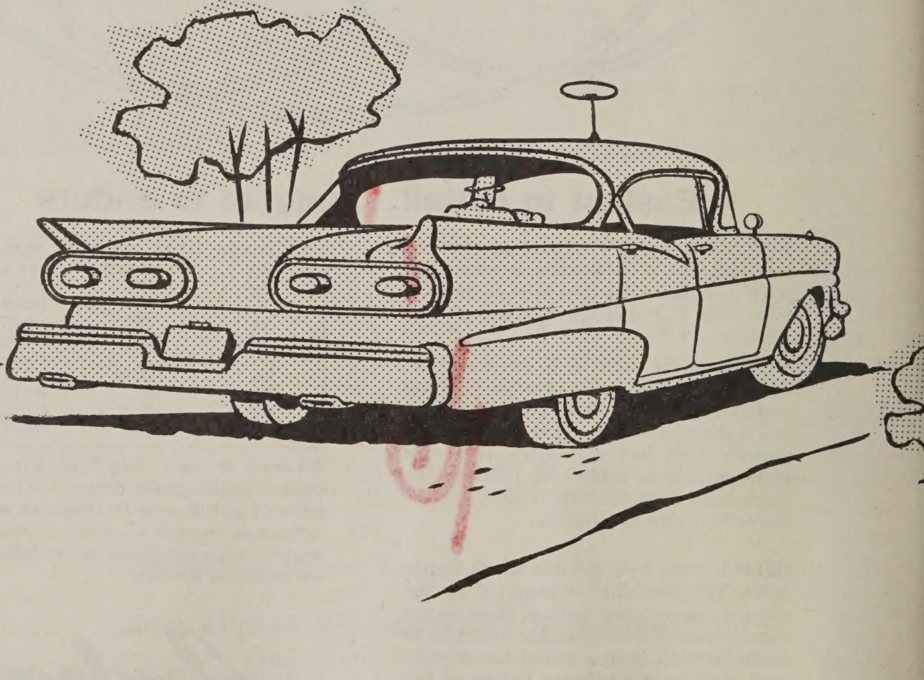
Selective Cross Polarization For The Reduction of Adjacent and Co-Channel Interference



by

ANDREW A. ANDROS, PRESIDENT
Hy-Gain Antenna Products Corporation

Some months ago our Engineering Department initiated a program to investigate the feasibility of horizontally polarized antenna systems for both base and mobile applications in the 150 and 450 mc. two-way communications bands. The selective use of both horizontally and vertically polarized antenna systems for this service would result in a cross polarization rejection of 50 db or more.

During the course of our experiments, the Federal Communications Commission was deliberating the possibilty of channel splitting into 25 kc. segments the 450 to 470 mc. band. This prompted our engineers to file the following comments although our project was not as yet completed. Since that time, the tremendous interest on the part of many communications companies has prompted publication of the complete comments together with some additional notes and a status report on the project.

(Editor's note: The following is the text of the Hy-Gain Antenna Products FCC filing made with the Commission concerning controversial Docket number 13847.)

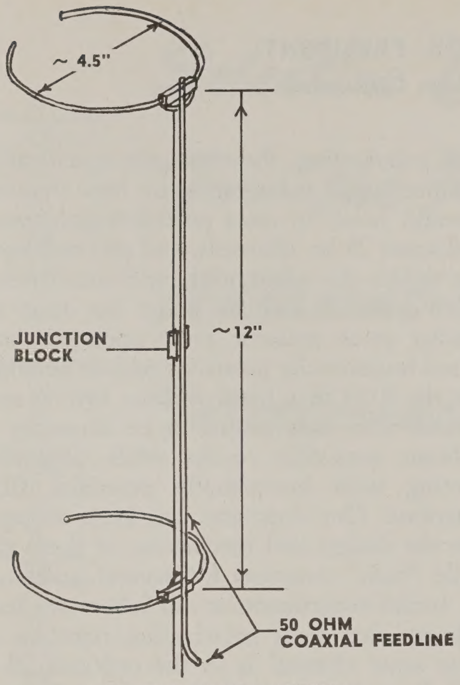
While Hy-Gain did not file comments under this docket, we have read the comments of Electronic Industries Association (EIA) and have noted their concern about the degrading of existing systems by stations which might be assigned the new 25 kc. channels. Being in the antenna business, we believe that the antenna engineering may provide the answer to this problem and respectfully ask that the commission consider our suggestion, although it has been submitted after the date for initial comments. We ask the Commission to consider the benefits that could result from specifying horizontal polarization on all new channels. Vertical polarization has been standard throughout the mobile services and we know of no mobile antennas in present production for horizontal polarization of 450-470 mc. Band. Consequently, it can be assumed that virtually all existing mobile systems in this band are using vertical polarization, therefore, the specification of horizontal polarization on new channels would result in cross polarization between adjacent 25 kc. channels, and this will serve to reduce the adjacent channel interference.

We would like to point out that for many years amateur radio operators have used horizontally polarized mobile antennas in the 50-54 mcs. band and the 144-148 mcs. band. This was found to be necessary to obtain consistent results while communicating with horizontally polarized fixed stations. Our company has been engaged in the design and production of these mobile "halo" antennas for several years.

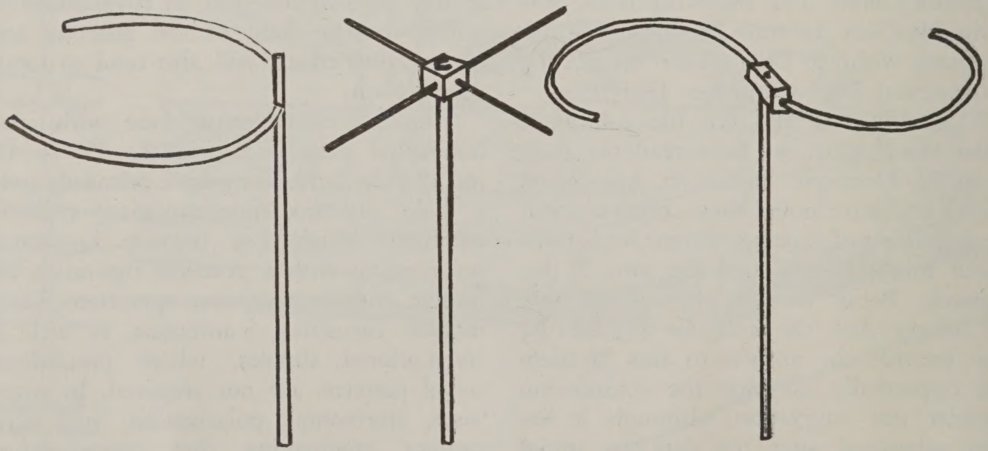
Initial exepriments at our laboratory have shown that cross polarization rejection on the same channel is in the order of 20 to 30 db without special precautions. By careful engineering radiated cross polarized energy could be reduced as much as 50 db. Naturally there will be some degradation in this performance due to re-radiation of objects in the field of the antenna and propagation effects will also tend to rotate polarization.

Although experiments done with cross horizontal polarization, in the 450 to 470 mc. mobile band, were done primarily with a "halo" antenna, there are many types of antennas which can provide horizontal polarization with a practical figuration for mobile and fixed station operation. These include turnstiles, S-antennas, as well as conventional dipoles, where omni-directional patterns are not required. In many cases, horizontal polarization will offer simpler engineering that corresponding vertical antennas, since grounding problems and decoulping from vertical supporting masts are eliminated. Gain performance of both fixed station and mobile antennas could easily be made to equal existing vertically polarized installations. The horizontal antenna would be mechanically as strong or stronger than corresponding vertical types. The actual rejection of cross polarized signals in field application is yet to be de-

UNITY-GAIN TYPES



3 DB GAIN MOBILE ANTENNA



HALO **TURNSTILE** **"S" ANTENNA**

SOME HORIZONTALLY POLARIZED MOBILE ANTENNAS FOR THE 450-470 mc BAND

termined experimentally, however, a general reduction of even 10 db will impose much simpler requirements on design of existing co-channel equipment. It is hoped by this company that it will be possible to use 25 kc. channel spacing with existing 50 kc. receiving equipment bandwidth, thereby, reducing the modification and retooling cost to manufacturers and users to a minimum.

In general, the cost of horizontally polarized antennas would not vary appreciably from vertically polorized antennas for similar service, either mobile or fixed. Shown are proposed sketches of possible engineering designs of various types of mobile and fixed station antennas which could be used for service in these regions. In general, you will note that the construction is simple, and sturdy, although a fair amount of engineering is involved—it is nothing serious and can easily be worked out.

As of this date (to our knowledge), the Federal Communications Commission has taken no action relative to the specific assignment of cross or horizontal polarization in the 25 kc. channels proposed for 450 mc. We feel strongly, and our experiments so far confirm, that cross polarization assignments of either adjacent channels or some selective manner of assigning horizontally and vertically polarized antenna systems would greatly alleviate the overcrowded conditions which today exist in the two-way bands. If, on the other hand, the commission for some reason decides not to

(Continued on page 18)

Exclusive Horizons Report

National Mobile Radio System
1961 Dallas Convention

(Editor's note: A last minute crisis at the Horizons' west coast headquarters office prevented Publisher Bob Cooper from attending the Dallas, Texas NMRS 1961 Convention. Washington Bureau Chief Robert E. Tall was on hand however and his report follows.)

As far as public reference is concerned, members of the National Mobile Radio System, meeting in annual convention in Dallas, Texas, voted Friday, September 15 to call themselves "Radio Common Carriers," as opposed to their more official (although apparently not industry appreciated) designation as "miscellaneous common carriers."

The registration of well over 100 selected Malcolm Moses of Farmington, New Mexico to steer the RCC industry through a maze of interconnection, state regulation, and business problems during the next year. Mr. Moses succeeds outgoing President Robert W. Miller of Honolulu, Hawaii.

A. J. Spooner of Oklahoma City was elected to the Vice Presidency post; Ralph Hicks of Tulsa, Oklahoma was named treasurer, exceeding Mr. Moses in that post. A. H. Stakely of Atlanta, Georgia was elected Secretary of the organization, taking over the responsibilities which have been handled so ably in the past by Clayton E. Niles of Tuscon, Arizona.

Mr. Hicks and Mr. Stakely were also re-elected to the Association's Board of Directors. Waco, Texas RCC operator Larry Bush was named as a new member to the NMRS Board.

In the most significant item of business at the four-day convention (which closed up shop on Saturday, September 16) the group named a member committee to study a proposed interconnection agreement currently offered to RCC's in many regions of the country by the Bell System. The new committee will also furnish assistance and information to RCC's requesting same during negotiation periods with the telephone companies.

The organization also voted on a new dues structure, based upon the number of mobile radio units served by the individual RCC. The new plan is expected to result in substantially increased monetary resources for the activities of the association.

The naming of the interconnection committe followed an extensive discussion of interconnection and state regulation considerations, looking toward implementing the "agreement in principle" on interconnection reached last year between representatives of the Bell System and NMRS.

During the discussion, more than a dozen RCC operators outlined their negotiations with Bell System companies on interconnection, which have resulted, in several cases, in the first contracts to be signed between telephone companies and the RCC operators.

The principal point of discussion was a standard contract now offered by Bell System companies. Mr. Spooner, leading off the discussion, described the interconnection agreement he has signed with Southwestern Bell Telephone Co. for Oklahoma City, involving a payment by the RCC to the telephone company of five cents per call originated by an RCC customer, carried through to a landline telephone, and a charge by the telephone company to its landline customer of ten cents a call feeding to an RCC mobile unit.

Mr. Spooner pointed out that Southwestern Bell, during negotiations on the agreement, had modified its originally offered contract in a number of respects to meet points raised by him with respect to liabilities, insurance, and wireline circuits. The one-year contract period originally offered, he noted, was also modified to put the pact on a 30-day basis, cancellable by either party.

As for the regulatory aspect of his situation, Mr. Spooner pointed out that the Oklahoma Corporation Commission has indicated it does not feel it should assert juris-

TRANSFER EFFICIENCY VS. REFLECTED POWER

$R_0 = R_r - \frac{Z_0}{4R_r}$ ohms,

$L_a = \frac{2953K_aK_b}{\ }$ inches,

$S = \sqrt{\frac{Z_0}{R_0} - 1}$.

Length (inches) $= \frac{5540}{\text{Freq. (Mc.)}}$

$E = \sqrt{PR}$

$\cos C = \cos A$

$= \sqrt{\frac{P}{R}}$

$K_b = 1 - \frac{X_a}{100K_x}$.

$k = \frac{S.W.R. - 1}{S.W.R. + 1}$

$S.W.R. = \frac{E_1 + E_2}{E_1 - E_2}$

$= \frac{B}{2} + \frac{480}{\text{Freq. (Mc.)}}$

Length (feet) $= \frac{492N}{\text{Freq. (Mc.)}}$

By ROBERT F. LEWIS
Vice Pres. of Engineering,
Prodelin, Inc.

It is the purpose of this note to suggest the term "Power Transfer Efficiency", or simply "Transfer Efficiency" be used to avoid some misunderstanding in the term "Reflected Power". By using the term "Transfer Efficiency" (hereafter referred to as "T.E.") one can discuss separately (a) the problem of maximum transfer of power from the final amplifier to a given load without considering the transmission line, and (b) the problem of Power Transfer from the input to a transmission line to the terminating load without considering the transmitter. By using this approach the term "Reflected Power" need not enter the discussion.

Consider the final amplifier of the transmitter with a load connected to its output terminal. It is desired to have maximum "T.E." between the power in the amplifier and the amplifier load. Maximum power will be transferred to the load when the load impedance is conjugate to the internal impedance of the amplifier. That is to say when the resistance values are equal, and the reactances are also equal but of opposite sign. The terms "match" and "mismatch" can be used to indicate the condition when the transmitter load is the conjugate of the internal impedance of the transmitter (matched) and (mismatched) when the load impedance is not the conjugate of the internal impedance of the transmitter. A simple relation gives the transfer of power related to the "matched" condition, or a "T.E." based on 100% transfer for the "matched" condition. This relation is

$$\text{"T.E."} = \frac{P}{P_M} = \frac{4S}{(S+1)^2} \times 100\%$$

where

P is the average power transferred for the "mismatched" condition.

P_M is the average power transferred for the "matched" condition.

S is the mismatch ratio between the load impedance and the internal impedance of the final amplifier. This ratio is not easy to obtain except experimentally.

From the above discussion it is evident that if the load impedance presented to the final amplifier due to a high VSWR on the transmission line is not of the proper value, the power transfer from the amplifier to the input of the transmission line may be greatly reduced, or the "T.E." will be low.

Now consider the transmission line problem. It is desired to transfer the power fed into the input to the terminal load with minimum loss. If a lossless transmission line is considered, whatever power fed into the input will be transferred to the output terminal without loss regardless of the VSWR, or the "T.E." will be 100%. This statement can be made since it has been assumed that there is no loss in the metal conductors or the dielectric between the conductors. In the practical case where some loss does occur, this loss is due only to the heating of the metals and dielectric, thus the "T.E." will always be something less than 100%. Minimum loss or maximum "T.E." will exist when the transmission line is matched. Figure (1) is a plot showing the "T.E." versus length in feet for various attenuation ratings given in db per 100 ft. Some reduction in "T.E." will be experienced as the VSWR increases. The A.R.R.L. Handbook 1960 Edition, Page 77, Figure 3.18 gives the additional loss in db for various values of VSWR. Figure (2) gives the same result except that the additional loss is expressed in percent reduction of "T.E." This percent must be subtracted from the "T.E." obtained from the matched condition to account for VSWR's greater than unity.

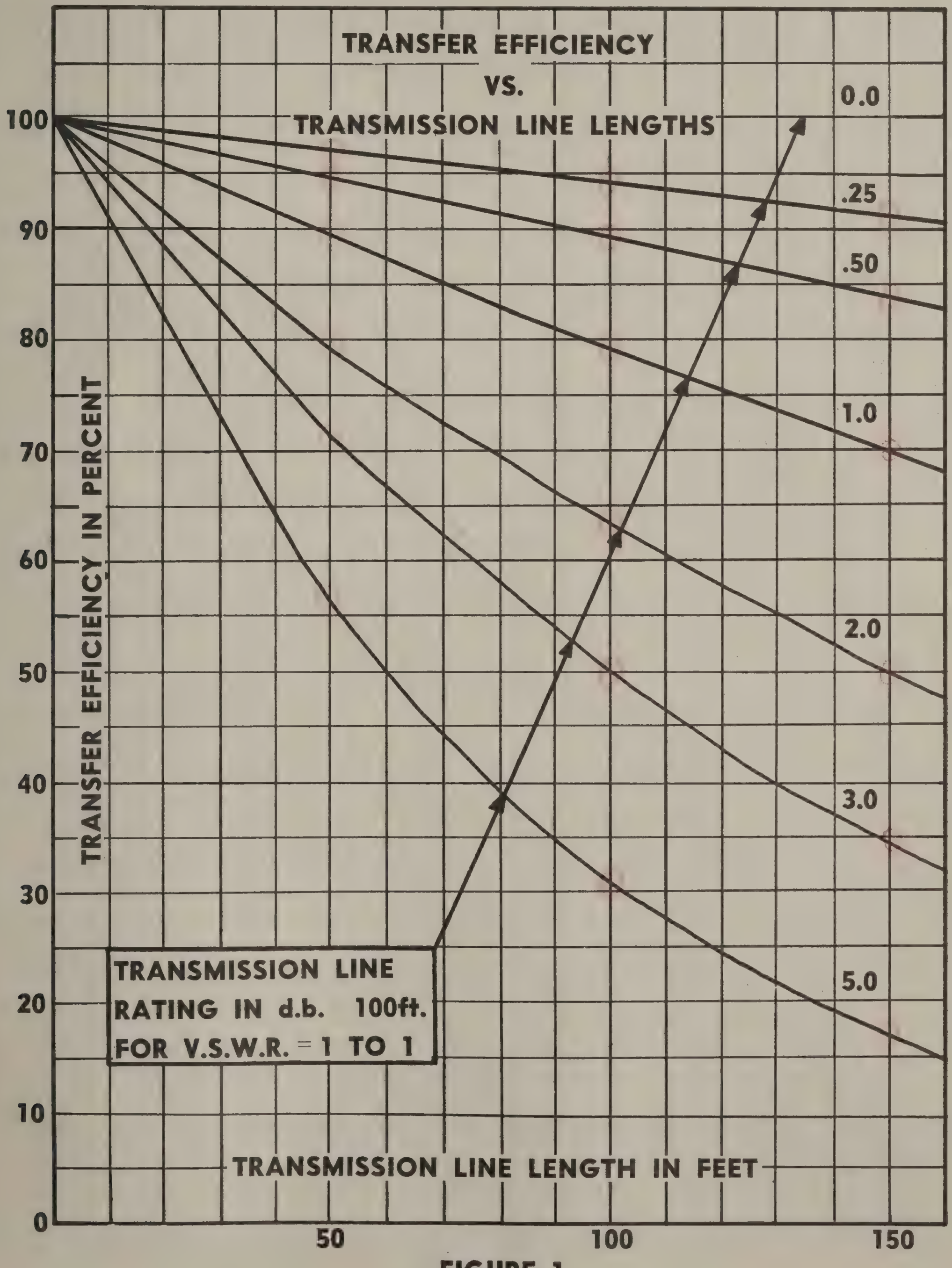


FIGURE 1

Using the example on the bottom of Page 77 of the A.R.R.L. Handbook concerning the VSWR of 10 to 1, it was evidently assumed that the 10 to 1 VSWR on the 600 ohm transmission line presented a "mismatched" load to the final amplifier of the transmitter such that S = 10.

Applying this value of S to the "T.E." of the amplifier to load is

$$\text{"T.E."} = \frac{P}{P_M}$$

$$= \frac{4 \times 10}{(10+1)^2} \times 100\% = .33 \times 100\%$$

or "T.E." = 33%.

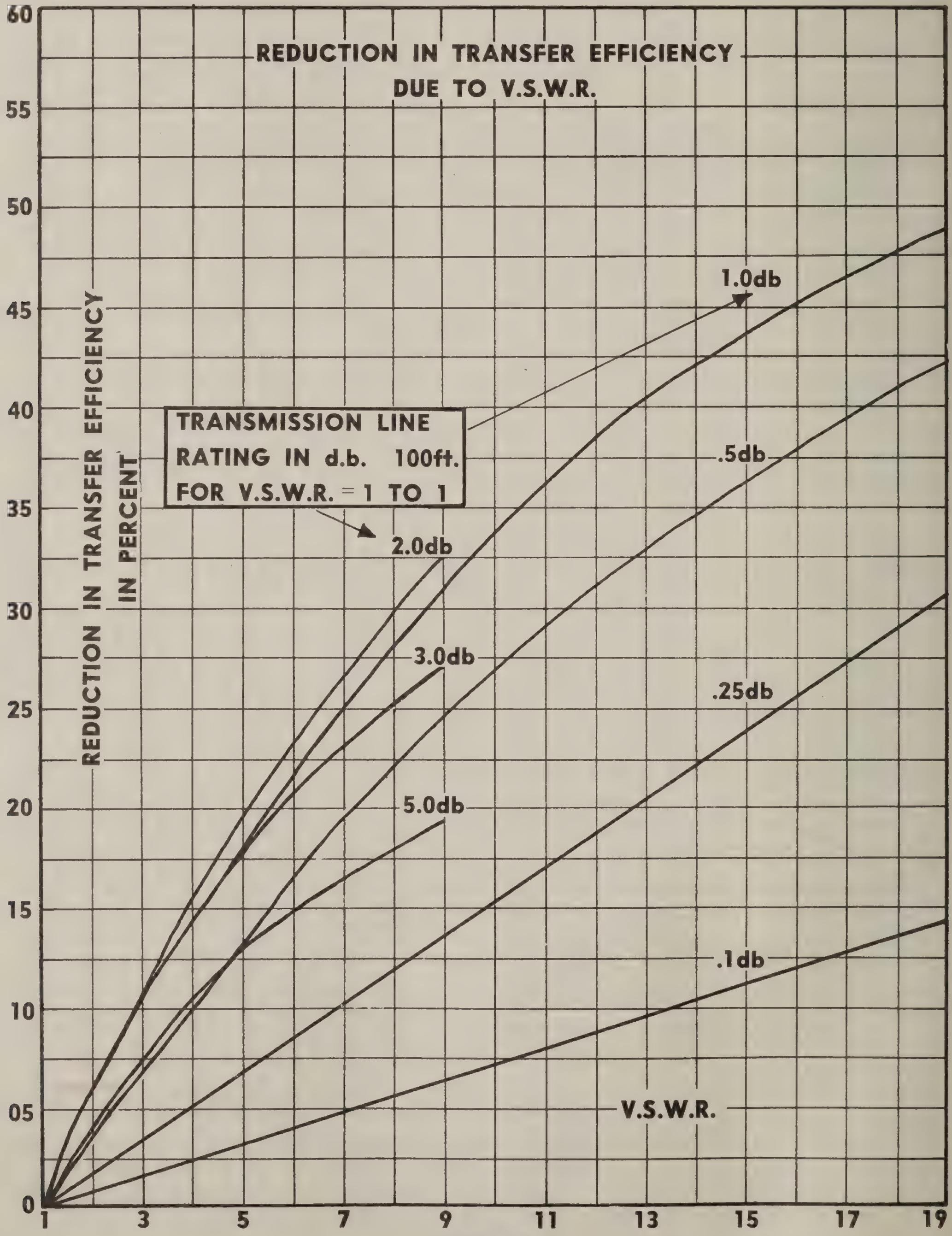


FIGURE 2

It was further assumed that P_M was 100 watts, thus 33 watts would be delivered to the input of the 600 ohm transmission line. However, since the transmission was assumed lossless Figure (1) shows 100% 'T.E." for 0 db or that 33 watts would appear across the 60 ohm terminal even though there is a 10 to 1 VSWR. Now suppose the internal impedance of the final amplifier was 60 ohms and that the transmission line was cut to an even multiple of an electrical half-wave thus presenting a load to the transmitter of 60 ohms. This would make S = 1.0 and the "T.E." =

$$\frac{P}{P_M} = 1.0 \times 100\%,$$

thus 100 watts would be transferred to the input to the 600 ohm line, and 100 watts would appear in the 60 ohm terminal load *without* increasing the power level of the transmitter. Remember the VSWR is still 10 to 1 on the transmission line so be cautious of the use of the term "Reflected Power". Obviously another solution would be to insert a match box or other circuitry to transform the impedance presented by the VSWR of 10 to 1 for arbitrary lengths to the conjugate or proper load impedance for the transmitter, and thus reduce S to approximately unity. The "T.E." would then approach 100% and due to 0 db attenuation on the transmission line practically all of the 100 watts would appear across the 60 ohm load.

The following examples will help in understanding the problem of "T.E."

A) Assume a 50 ohm transmission line terminated in 50 ohms. Assume that the attenuation is 0.5 db per 100 ft. at some given frequency. Suppose that 70 ft. of this transmission line is used between transmitter and antenna. Since the VSWR is 1 to 1 on the transmission line, the "T.E." is 92.5%, Figure (1). If 100 watts is delivered to the input of the line then 92.5 watts will appear in the 50 ohm terminal load. If 150 feet of transmission line is used, the "T.E." for VSWR = 1 to 1 would be 84%, Figure (1), or 84 watts delivered to the 50 ohm terminal load.

B) Assume a 300 ohm open wire transmission line terminated in 50 ohms. Let the length of the transmission line be electrical one-half wavelength at 4. mc. or approximately 114 feet. Assume the attenuation to be 0.05 db per 100 feet. From Figure (1) the "T.E." is some 98% for the matched condition. However, the VSWR is 6 to 1, and thus the "T.E." is reduced by some 3%, Figure (2), or the resultant "T.E." is now 98%-3% =95%. Again if 100 watts is delivered to input of the transmission line 95 watts will appear in the 50 ohm terminal load. In the above two problems (a), and (b), it is assumed that the internal impedance of the amplifier is 50 ohm, and thus S is unity.

C) Assume the same 300 ohm transmission line is in (b), but now terminated by 300 ohms, thus a VSWR of 1 to 1. If the length is assumed the same and the attenuation is 0.05 db per 100 feet at 4. mc., then since the line is matched the "T.E." is 98%. But now the 300 ohms does not match the internal impedance of the amplifier. The mismatch ratio $S = \frac{300}{50} = 6.0$. The "T.E." from the amplifier to the 300 ohm input to the transmission line is now

$$\text{"T.E."} = \frac{P}{P_M}$$

$$= \frac{4 \times 6 \times}{(6+1)^2} 100\% = 0.49 \times 100\%$$

or the "T.E." from amplifier to amplifier load is 49%. If 100 watts could be transferred when S is unity (internal impedance 50 ohms) there is now available at the input to the transmission line only 49 watts. Using the 98% "T.E." on the transmission line, 48 watts will appear in the 300 ohm terminal load.

It is hoped that the above discussion and associated problems will give a better understanding of the "Transfer Efficiency" between final amplifier and its load, and between the input of the transmission line to its terminal load.

RFL

service notes FROM AEROTRON

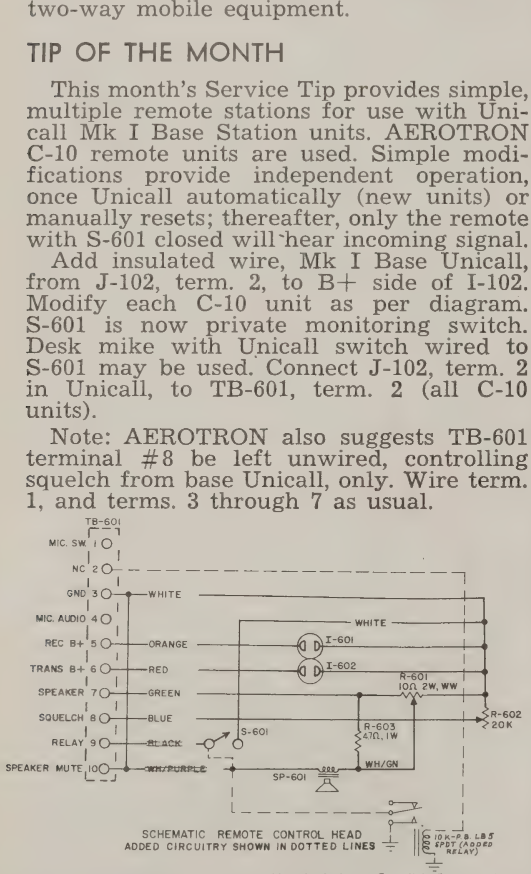
This is the second in a series of monthly newsletters to appear in Communication Horizons with service tips and other information for use by those involved in the installation and maintenance of AEROTRON two-way mobile communications equipment. AEROTRON will pay $10.00 for the "Service Tip" of the month which may be written in 100 words or less, on any subject relating to the installation or maintenance of any model of AEROTRON two-way mobile equipment.

TIP OF THE MONTH

This month's Service Tip provides simple, multiple remote stations for use with Unicall Mk I Base Station units. AEROTRON C-10 remote units are used. Simple modifications provide independent operation, once Unicall automatically (new units) or manually resets; thereafter, only the remote with S-601 closed will hear incoming signal.

Add insulated wire, Mk I Base Unicall, from J-102, term. 2, to B+ side of I-102. Modify each C-10 unit as per diagram. S-601 is now private monitoring switch. Desk mike with Unicall switch wired to S-601 may be used. Connect J-102, term. 2 in Unicall, to TB-601, term. 2 (all C-10 units).

Note: AEROTRON also suggests TB-601 terminal #8 be left unwired, controlling squelch from base Unicall, only. Wire term. 1, and terms. 3 through 7 as usual.



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AEROTRON

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NEWS BRIEFS

FCC Axe To Swing In New Areas

The FCC has been asked to concentrate more on illegal Safety-Special radio uses by Sen. Karl E. Mundt of South Dakota. The suggestion came up unexpectedly during Senate Government Operations investigations subcommittee hearings on gambling and other illegal activtities.

Senator Mundt said that he feels the FCC should direct more of its attention to monitoring and enforcement of these radio services, with a view to cracking down on illegal use of non-broadcast facilities, while concentrating less on the broadcast field.

New Civil Defense Developments

In one of the first moves of the Defense Department in connection with its recent assumption of many of the responsibilities formerly handled by the Office of Civil & Defense Mobilization, Sec. of Defense Robert S. McNamara announced that he has approved the allocation of $12-million in matching funds to assist the states in the cost of personnel and administrative expenses of their Civil Defense programs.

FCC Finalizes Rulemaking

The FCC finalized rulemaking changing in its marine radio regulations to permit frequency measurements and modulation adjustments of radio stations on shipboard in the marine services to be made "with the transmitter installed aboard the vessel for which it is licensed or at a service or test bench under load conditions equivalent to those of actual operation."

More Talk About 39.06 MC Action

Latest filings with FCC favoring prospective FCC action which would permit the use of the frequency 39.06 mc. in the local government radio service, by transmitters installed in emergency vehicles to control traffic lights ahead of them, were the New England Association of Fire Chiefs, Inc., the Eastern Association of Fire Chiefs, Inc., the Hamden, Conn., Dept. of Fire Service, the Elmira, N.Y., Police Department.

11

16

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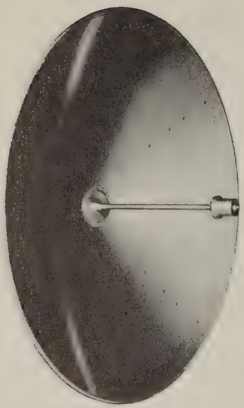
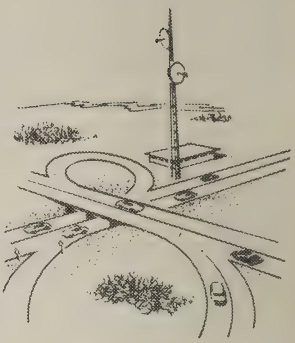


MICROWAVE RELIABILITY



Paper Presented By

JOHN D. CUPP

Andrew Corporation, APCO Conference, Long Beach, California

It should not be necessary to refer here to the *importance* of systems' reliability. The fact that reliability is one of the major problems of public safety is, in itself, quite impressive. The purpose of this paper is to point out some of the methods where we, as a manufacturer, can better serve the user by providing the latest of the state-of-the-art in systems' reliability. This encompasses, on the part of manufacturers — antennas, transmission line, waveguide and a great deal of accessories associated with them.

Following recent FCC rulings, microwave is fast becoming of greater interest. As this interest gains momentum, the utilization of microwave will increase.

This, of course, is not an astounding fact. However, a direct result of the new rulings by the FCC is more available space in the microwave spectrum. This space will partially be filled by many of the public safety groups that APCO represents, and, therefore, any problems that may arise as well as any benefits derived, will, in large measure, directly affect most of those in attendance here.

First of all, let's look at microwave *antennas*. There are certain terms and specifications established relative to antennas and systems that aid in providing performance. These terms and specifications are published by EIA (formerly RETMA) and are established by joint effort on the part of the user, the manufacturer, and particular government agencies.

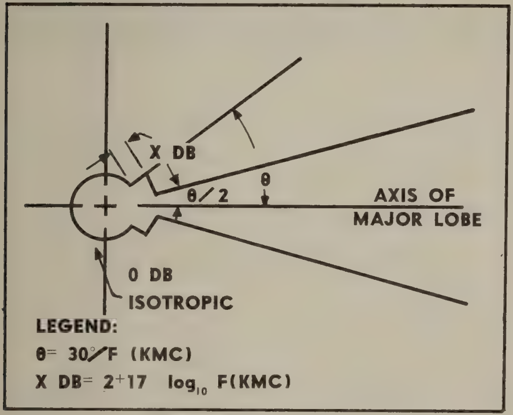
One of these terms is the Keyhole Pattern. This is a pattern concept, standardized to provide the best radiation pattern for microwave antennas. The pattern is named for its shape (figure 1).

$\theta = \frac{30^\circ}{f\ (kmc)}$; XDB = $2 + 17 \log 10\ f$ (kmc).

Maximum power density is obtained with the largest available antenna and maximum power transmitter. If the radiation exceeds the limit shown, it is reduced to the limit by reduction of the transmitter output.

For our consideration here, the importance of the keyhole pattern is in its provision for extremely low side and back lobes. This, in many cases, may be of no consequence in an *initial* installation. However, due to the expected increase in microwave usage, and with an eye to *long term* system reliability, the provision for low side and back lobes becomes of great importance. A system engineered around antennas meeting the keyhole pattern will preclude, or at least greatly reduce, the possibilities of future interference. This is a major step towards system reliability.

The mechanical aspects of an antenna system cannot be overlooked either. They, too, play an important part in the provision and maintenance of a system designed for long term reliability. The ruggedness that is an integral part of every ANDREW antenna aids in providing stable paths as well as long life in a microwave system. The choice of materials, material thicknesses, bracing, mounting and finishes are such as to provide the optimum reliability in each microwave antenna.



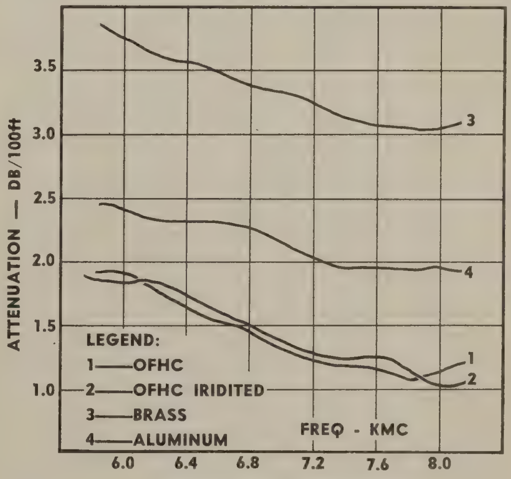
KEYHOLE PATTERN
FIGURE 1

In many instances, severe climatic conditions prevail to the extent that provisions for reliability can prove costly. Different methods are employed to insure that antenna systems will withstand severe winds. In other areas, icing is a problem; in yet others, icing and wind combined, provide unwanted conditions. In order to combat these conditions, rugged and costly supporting structures are installed; various other methods have been contrived to preclude the possibility of antenna system failure.

The least expensive and easiest way of overcoming *some* of the problems is through the use of *radomes*; heated radomes for areas experiencing severe icing and unheated radomes for areas menaced by high winds alone.

An unheated radome alone serves a multitude of purposes. The unique airfoil design of ANDREW radomes provides for a 35% reduction in wind loading over uncovered dishes. This permits a substantial savings in tower and other supporting structure costs. Unheated radomes also serve to protect the antenna from leaves, dust, and flying objects. In areas that experience heavy icing, the heated radome has proven to be the answer. It provides all the features of the unheated radomes, plus the advantage of reducing the forming of ice. This, of course, prevents loss of signal due to ice and provides for a greater safety margin in the expected strength of a given tower or supporting structure.

Still another feature that enhances a microwave system is employment of pressurized feeds. An engineer or microwave user utilizing a pressurized feed in a microwave system is taking yet another step towards guaranteeing the reliability of his system. In most cases, feeds utilize dry air or nitrogen for the dielectric. This provides a low loss feed as well as keeping contaminants out of the feed system. Contaminants such as fine dust, moisture, etc. create added losses in a microwave antenna system. In time, they can cause system failure by creating an antenna system breakdown.



WAVEGUIDE ATTENUATION
VARIOUS MATERIALS
FIGURE 2

In line with the discussion of feeds is the waveguide feeding the antenna. This item ranks *quite* high in providing for the reliability we seek in antenna systems. Of special importance is the inherent loss of a waveguide, both initially and over a period of time. ANDREW utilizes only oxygen-free high conductivity copper in the manufacture of waveguide. Through extensive engineering tests, OFHC copper has been proven to exhibit the lowest loss, lower than aluminum or than brass or other copper alloys.

Corrosion, if it occurs inside the waveguide, will greatly increase system loss. OFHC copper waveguide has high resistance to corrosion. However, some oxygen still exists in the copper. Even though the waveguide is pressurized, some oxidation occurs unless a protective coating is provided. In research toward better performance and greater system reliability, ANDREW engineers have found that by iriditing the inside as well as the outside of the waveguide, corrosion and increase in loss is virtually eliminated. As can be seen from the curves, there is very little difference in the initial attenuation between unprotected and iridited waveguide.

The failure of flange joints and buckling and/or warping of waveguide are ever recurring causes of systems' failure over a period of time.

An important feature in maintaining a reliable waveguide run is the selection of proper waveguide hangers. Utilizing proper hangers such as spring, rigid and sliding hangers prevents distortion and other undue stresses in the waveguide. Another point to consider in providing systems' reliability is the use of *silver soldered* flanges *instead* of soft soldered or other forms of low temperature solder. Cracking of soft soldered flanges around the guide may occur over a period of time due to the constant vibration created by tower movements, etc.

Another source of loss and perhaps even breakdown in a system is condensation inside the waveguide. By utilizing pressure tight guides and maintaining adequate pressure in the waveguide, this source of loss is kept to a minimum. This, in turn, increases the long term reliability of the system.

We have herein attempted to deal with the factors to be considered in providing an antenna system with the reliability, both initially and over a period of years.

Recommendations from the users of microwave equipment aid in the constant search for new and better ideas. Every suggestion, question or comment is taken in good faith, recorded and studied by our Engineering Department. Therefore, it can be seen that suggestions from users as well as the factors described in this paper, contribute toward the reliability we all seek. We will appreciate recommendations any of you may have for further improvement of reliability of microwave antenna systems.

J.D.C.

Selective Cross Polarization

(Continued from page 6)

make formal antenna polarization assignments, communications companies and users could possibly benefit greatly by selecting either horizontal or vertically polarized antennas depending upon use conditions in their particular area.

As our experiments continue, it becomes more and more evident that horizontally polarized antennas are equal in efficiency and coverage to vertical types for base to mobile applications. In addition, we have provided a number of experimental models to various communications companies in crowded metropolitan areas. Their initial reports are very gratifying showing, in many cases, signal to interference rejection of 30 db and more. With careful matching and decoupling, it appears that even greater separation can be expected.

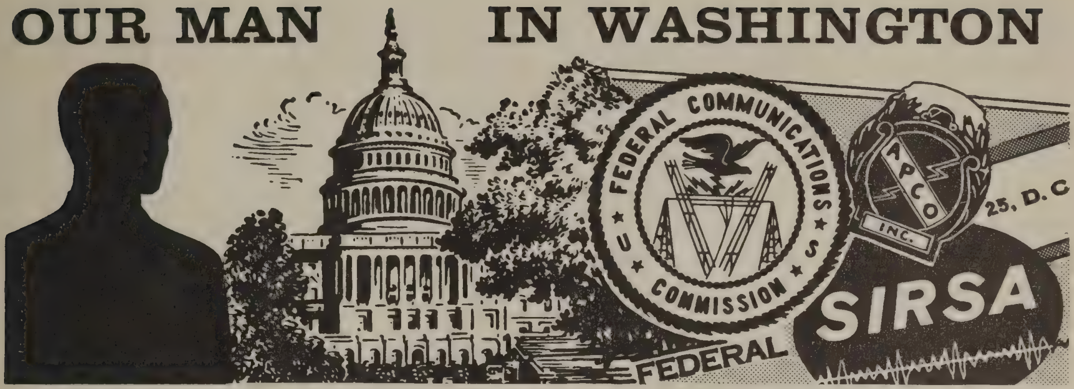
Announcement of additional engineering data will be published in forthcoming issues of Communication Horizons.

A.A.

THREE SY-PEP PAPERS

are in this issue
of Communication Horizons.
Have you submitted your SY-PEP
paper yet? See page
one for full details.

OUR MAN IN WASHINGTON



> Robert E. Tall's Washington Report has been superceded during this past month's inactive vacation period at the Commission by the following special report. Mr. Tall's regular column will return in November.

SALES PRACTICES CRACKDOWN

Two-way sales representatives who feel they have heard the story before and are inclined to scoff at the FCC's latest muscle-flexing directed at improper advice to customers with regard to Commission regulations, are being advised by COMMUNICATION HORIZONS to take a second look at the situation. We've heard the story before, too, but we're impressed this time.

In the sternest action of its kind in some time, the FCC has just warned 60 companies engaged in the manufacturing and distribution of two-way radio equipment for use in the business radio service that a growing list of reports of illegal activities on the part of "some manufacturers" is going to result in a serious campaign to curb the practices.

The Commission's specific effort does not encompass sales practices of 60 different types of equipment, of course, since most of the companies who received the warning are not actively selling business radio equipment, despite the fact that they have had two-way radio units "type-accepted" by the Commission.

The scope of the warning, however, does make it clear that the FCC is blanketing its "crackdown" area—by sending the word to anyone who might be involved—to strengthen its hand in future litigation by giving it the force of being able to prove that any company it might charge in the future with improper practices had been amply forewarned.

The Commission's campaign is aimed particularly at stamping out encouragement given by two-way radio salesmen to new licensees to use unlicensed equipment. In the past the Commission has had to prove, under the Communications Act, that such encouragement was offered to the customers in a "willful" violation of the Act, to make its charges stick. By the blanket notice, however, the agency can merely prove service of its warning on the offending manufacturer and go into more advanced enforcement litigation much better armed that it has ever been before.

Response from the equipment manufacturing fraternity to the FCC's plea for dissemination of its warning to radio salesmen has been immediate, with most of the reputable companies reporting that they have notified all of their salesmen, or distributors, of the agency's campaign, and pledging cooperation with the Commission in halting unauthorized practices.

The companies' actions extend the implications of the Commission's cautioning note by putting the individual sales personnel on official notice that there are sanctions against the giving of misinformation to their customers or prospective customers.

The FCC, in its warnings, has officially recognized that "some manufacturers of two-way radio equipment for use in the business radio service, and their authorized representatives and distributors, may be encouraging unlicensed radio operation" by informing the purchasers of their radio equipment that it may be placed in operation by the purchasers "either by using the call sign of the seller's radio station, or without a station license, while they are waiting for the Commission to issue a radio station license in their name."

The agency notes that "a radio station license is required for the use or operation of radio transmitting apparatus in the business radio service by the Communications Act, and the illegal operation of any radio transmitting apparatus may result in the imposition of severe criminal sanctions or in the institution of other enforcement action by the Commission."

On another point, the Commission warns that under the Communications Act, "the prior consent of the Commission is required for the transfer or assignment of any radio station license or the rights granted thereunder," and "One who fails to observe this . . . by the purported transfer of his operating authority subjects himself to possible license revocation and such other enforcement action as the Commission may consider warranted . . ."

On a third major provision, the FCC specifies, its rules provide that the business radio rules do not permit a "purchaser or prospective purchaser" to operate radio facilities "either under the call sign of the manufacturer, distributor or manufacturer's representative, or otherwise" before a license is issued for the particular station involved, and "The denomination of such unlawful activities as 'equipment demonstrations' does not render them any less illicit."

While the preponderance of quality two-way radio sales today is in the business radio field, of course, the note of caution from the FCC is not restricted to that area. One of the officials concerned with backing up the Commission's campaign stresses that the agency has no intention of striking exclusively at the business service, and that the same type of program is going forward in other areas.

Supporting the FCC's program at the Congressional level, Senator Karl E. Mundt (R., S.D.) in recent hearings before the Senate Government Operations investigations subcommittee, asked FCC Assistant General Counsel Dee W. Pincock to relay to the Commission the concern of the Senate group with respect to illegal operations geing carried on by non-broadcast licensees of the Commission.

During Mr. Pincock's appearance before the Senate subcommittee, Senator Mundt said he feels the FCC should direct more of its attention to monitoring and enforcement of the various safety and special radio services, with a view to cracking down on illegal use of non-broadcast radio facilities, and concentrate less on the broadcasting field.

The growing list of license revocations by the FCC indicates to COMMUNICATION HORIZONS that the Commission is ahead of Senator Mundt, and is making no idle threats; nor is it prepared to back up on this, its latest major push toward enforcement of its rules. We recall only too clearly the outright revocation of the radio licenses of a major West Coast radio manufacturing company this past March for illegally permitting use of its call sign by purchasers of its equipment, and we've kept score from that point.

The FCC means business, and we sincerely hope none of our readers becomes the subject of an enforcement news article in our pages.

R.E.T.

EXCLUSIVE HORIZONS REPORT

(Continued from page 8)

amount of the added charge for the interconnection service, he said, goes to Hawaiian Telephone.

The Honolulu operator said there has been no customer reluctance to the tariff structure, and that no troubles have developed between his company and Hawaiian Telephone during the two years the service has been in effect.

Mr. Niles, summing up the panel discussion, described the interconnection-regulation problem as the "most important consideration facing the RCC industry at this time.

The initial "elation" of the NMRS members who negotiated the "agreement in principle" with the Bell System on interconnection, he said, resulted in a situation where "we were so impressed with our accomplishment" that NMRS failed to take the next steps necessary to obtain a rapid implementation of the policies agreed upon.

Mr. Niles, and another RCC operator in Mountain States Telephone and Telegraph Co. territory, pointed out that Mountain States has appeared anxious to reach agreement on interconnection contracts. Looking into the Arizona constitution, he said, he discovered that RCC operations in that state "clearly" have the statuts of communications common carriers and all such carriers, including telephone companies, are under legal obligation to connect their facilities where necessary to transmit messages between parties.

This indicates, he said, that it was not NMRS, but rather the "law" that persuaded the Bell System to enter into the interconnection "agreement in principle." The Arizona law further specifies, he related, that if the connecting common carriers do not agree on a division of revenues from communications traffic involved, the state regulatory commission is to prescribe such a division. Mr. Niles expressed the opinion that the Arizona constitution was patterned after constitutions in other states, and urged the NMRS members to look into their own state laws.

Features of the standard contract being offered by the Bell System companies, he said, involve a request MCC's to furnish telephone companies with proposed RCC tariff charges 45 days in advance of their filing with the FCC or state commission; a provision putting the RCC in the status of an "agent" of the telephone company, rather than in a position of being a "connecting carrier;" a provision which would limit the interconnection of traffic to and from RCC mobile units, to the exclusion of traffic to and from fixed installations; liability provisions; insurance provisions; and proposed restrictions on the assignment or transfer of the RCC station.

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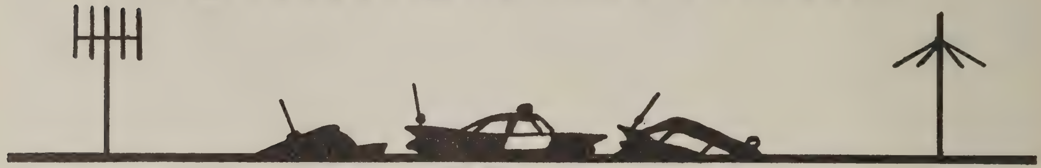

Material Prepared and Submitted by

ROBERT E. BROOKING

Communications Engineer
City of Burbank, California

THE RADIO SPECTRUM—A NATURAL RESOURCE

One of the outstanding traits of the American people is that they take so many things for granted. For example, they assume that to obtain water which is safe to drink, it is only necessary to turn a faucet. The doctors' advice to those planning to travel to foreign countries—don't drink anything unless it comes out of a bottle including water—comes as quite a shock. We drive our cars to the gas pump never bothering to wonder about the source of the crude oil. We have always accepted a philosophy of plenty. Time was when the same was true of our forests and our fish and game; but in recent years, it has become necessary for the various governmental entities to take steps to prevent the depletion of these natural resources. Thus today we have in this country Departments of Forestry Conservation, Departments of Fish and Game Conservation and Departments of Water Resources.

One of the most valuable natural resources is the radio spectrum. Today it is used to provide not only for our comfort, convenience and entertainment, but also it is essential to our security as a nation, to our safety at sea and in the air and to the public safety in general. However, unlike fish, game or trees, we cannot grow more radio spectrum; recent developments having already carried us far beyond the portion of the spectrum which lends itself to the requirements of the various mobile services. We, the users, can only make better use of the space available; either by using narrower channels with the attendant increase in engineering, technical and maintenance difficulties or by obtaining additional spectrum space through a realistic approach to spectrum utilization. The first of these two methods has already been effected through implementation of the split-channel dockets.

Fifteen years ago the channels used by the various land mobile services were set up with 40 kc. spacing in the 30-50 mc. band and 60 kc. spacing in the 152-162 mc. band. However, assignments were made on a basis of alternate channels being assigned in the same area, with adjacent channels having geographical separation as well. In 1948 the New York City Fire Department undertook an engineering study for the purpose of developing an adequate radio communication system for the Department. The 30-50 mc. band was rejected because of the excessive noise level in the densely populated metropolitan area. This left the 152-162 mc. band, with a total of thirteen assignable channels. Since eight different frequencies were needed, it became obvious that it would be necessary to use adjacent channels for this system. However, receivers in use at the time did not possess sufficient selectivity to make possible the successful operation of such a system. Then, in 1949, a receiver was developed using a sealed filter having a pass-band of plus/minus 15 kc. and 100 db attenuation at plus/minus 30 kc. making adjacent channel operation in the same area a reality. Conservation of the radio spectrum had begun, thanks to the Public Safety Radio Users and the manufacturers supplying their equipment. On January 12, 1955, the Federal Communications Commission brought forth Docket 11253 proposing amendments to Parts 2, 6, 10, 11 and 16 of the Commission's rules to reduce separations between assignable frequencies in the 25-50 mc. and 152-162 mc. band. This Docket proposed a reduction of FM swing from 15 kc. to 5 kc. and a reduction of separation between assignable frequencies to 20 kc. below 50 mc. and 15 kc. in the 152-162 mc. band with geographical separation in the order of one-half of co-channel mileage separations. 30 kc. separation was proposed for the same area operation. The Commission recognized that even with the narrow band filters, there would be a deterioration in signal to noise ratio of 3 db.

Conservation of spectrum space is one thing but degradation of services essential to safety of life is quite another. Commissioners Bartley and Lee recognized this and in statement of dissent commented, *"In our opinion this Notice of Proposed Rule Making attempting to alleviate the congestion of channel occupancy in the non-government land-mobile radio services by reducing channel spacing, may serve merely to complicate further some basic problem with which we are confronted today."*

How true. Docket 11253 was adopted and today we have the complications of interspersed assignments, frequency stability requirements ten times more critical than before, greater susceptibilty to ignition and other interference and a loss of service area. In a number of large metropolitan areas, the Public Safety Radio Services are still suffering due to a shortage of usable frequencies. The Fire Radio Service still has no means of providing repeater operation to agencies with large areas of responsibility except by cross-band operation.

These problems will be discussed in this column in future issues of Communication Horizons.

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$59.10 List

- Heavy duty construction
- Two half wave elements
- Can be cut to frequency
- Mounts on standard 1¼" pipe
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- SWR less than 1.5-1

Other models available up to 3 elements for higher gains.
(144-160 Mc.) (450-470 Mc.)

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- Functions independent of mounting structure
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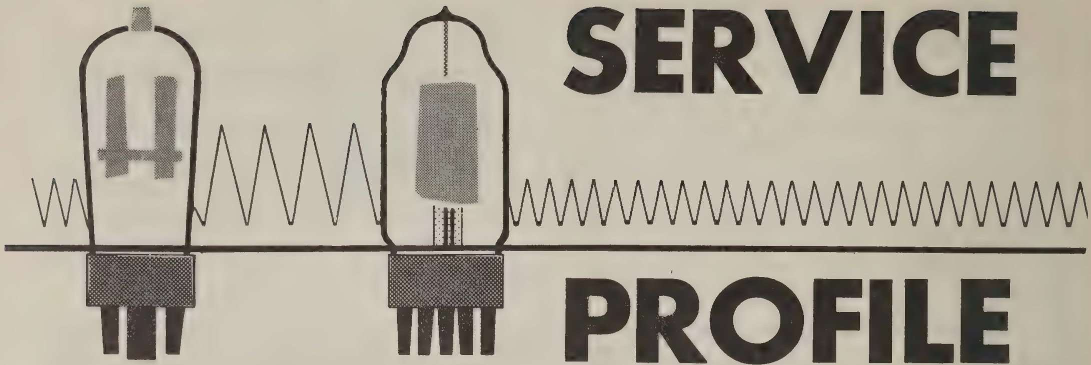


SERVICE PROFILE

MINER IS MAJOR FORCE IN INDIANA SERVICING

Two-way radios operating in the industrialized Calumet Region are serviced by Miner Electronics, Inc., Hammond, Indiana.

Operated by the father-son team of Harold and Jack Miner, this progressive Motorola subcontractor maintains nearly 1,000 mobile two-way radios including the extensive networks of the Inland Steel Company, United States Steel, Youngstown Sheet and Tube Company, Commonwealth Edison, the Hammond Police and Fire departments and numerous business concerns.

To provide only the highest quality service for these many accounts, Miner Electronics calls upon experience, a full staff of technicians, several complete lines of test and service equipment, extensive garage and "drive-to" facilities, and comprehensive support from Motorola.

Thousands of dollars have been invested in service and test equipment.

The equipment is used for servicing radio gear at the shop and for handling calls at the customer's location. Shop facilities are contained within 2,700 square feet of space. This does include a garage for servicing units in vehicles brought into the station.

Rapid growth, made possible by quality servicing, has prompted Miner to add a second garage, now under construction.

Besides equipping its service benches, Miner Electronics has stocked five vehicles used for making "drive-to" service calls.

The Hammond firm currently employs three experienced technicians. Currently, one man is enrolled in the new Motorola Training Institute, a 38-lesson home study course on maintaining two-way radio equipment.

Jack Miner, co-owner of Miner Electronics, Inc., Hammond, makes service call at customer location. Miner Electronics has five fully stocked vehicles for handling "drive-to" calls.

Around-the-clock servicing is provided by Miner, which operates its own radio system for instant follow-up customer calls.

If experience were wealth, Harold and Jack Miner would be among the richest men in Indiana. The experience of Harold Miner dates back to World War I when he served with the U.S. Army Corps, After the War, he went to work in Davenport, Iowa for WOC, one of the first radio stations in the nation.

Jack Miner, born into an electronics family, rates as a "natural" technician. During World War II, he was part of a vital radio teletype team in the South Pacific.

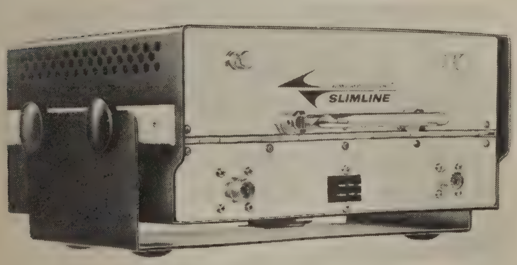
(Continued on page 28)

CH SHOWCASE

NEW PRODUCTS IN THE PROFESSIONAL COMMUNICATIONS FIELD

AEROTRON (Aeronautical Electronics, Inc), P. O. Box 6527, Raleigh, North Carolina has hit the two-way VHF communications market with a brand new high-powered two-way mobile set. Aerotron states their new 100-watt Slimline Model 6N100/SLT is the only 100 watt mobile radio set available today, "giving greater car to car, car to base station range and eliminating dead spots."

Flexibility and reliability are achieved by combining a compact under-dash transmitter-receiver with a high power amplifier unit located in the trunk or some other convenient location. The Model 7N100/SLTA for low band operation is also available.



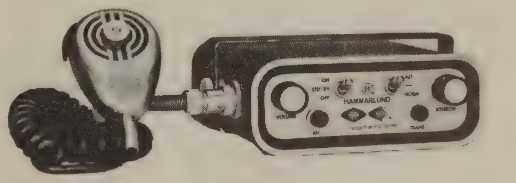
Aerotron Model 7N100/SLTA

Battery drain in normal operation is held to a low value as the operator has the option of choosing normal power output for local calls or full 100 watts output for more distant calls. The under dash unit weighs in at 9 pounds while the amplifier weighs less than 14 pounds. Optional equipment includes two or three channel operation and Aerotron's new compatible UNICALL.

A "piggy-back" feature of the new equipment is its ability to up-date any equipment in the 10-30 watt category by simply adding the 100 watt Aerotron amplifier alone.

Price, complete with all standard accessories, is $595 for the VHF system, $615 for the low band; $250 for the amplifier alone. Delivery from stock began September 15.

OUTERCOM ELECTRONICS, 502 Charlottetown Mall, Charlotte, North Carolina has introduced a new Remote Control Head for use with the Outercom FM-50-A two-way communications system. The unit occupies slightly more than 1/10th the space of the basic transceiver (see page 26, August CH) but retains all of the control functions of the unit.



Remote Control Head for Outercom FM-50-A

According to Outercom, conversion to the Remote Control Head is swift and uncomplicated. A flick-of-a-switch transfers the "brain" of the basic unit to the remote head—there are no additional relays, external speaker or microphone cables to contend with. The speaker used in the remote control head is identical to that used in the FM-50-A basic transceiver.

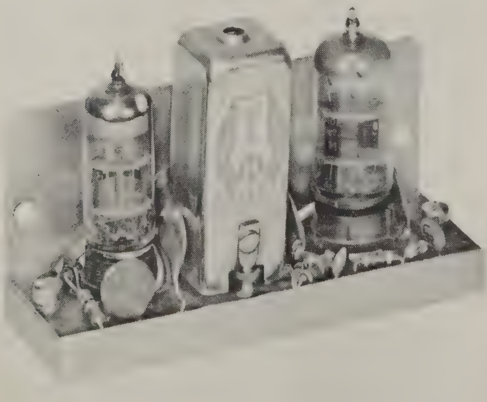
Physical size of the head is 2¾ inches high, 7¾ inches wide and 5¾ inches length.

OUTERCOM has also announced a new split-channel monitor receiver. The new MR 30-X and MR 50-X operate from 110 volts a.c. utilizing a built in whip type antenna or external antenna. The receivers are available for use on any crystal controlled channels within the frequency range of the receiver. Designed for 24 hour operation, the Monitor Receivers can be factory supplied with one, or up to four channels. The model MR 30-X covers the 25-54 megacycle range while model MR 50-X covers 147-174 megacycles.

Outercom MR 50-X

HALLET Manufacturing Company, 5910 Bowcroft Street, Los Angeles 16, California has supplied further information on their new "electronic Message Master" ignition surpression system. Hallet lists some of the advantages to their system as:

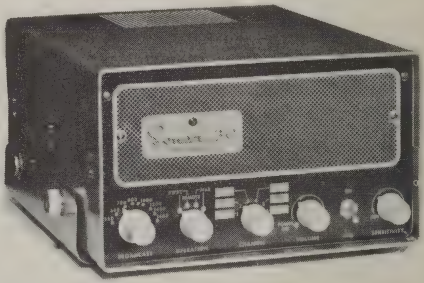
(1) Simple circuitry and component parts which service technicians have understood for years
(2) Minimum installation time (approximately 25 minutes).
(3) No special tools or technical knowledge required for installation.
(4) No loss of receiver sensitivity.
(5) Negligible power requirement.



Hallett Message Master

(6) Positive continual message intelligence —no saturation potential.
(7) No special maintenance ever required.
(8) Effective at all communication frequencies.
(9) Improves operating personnel efficiency.
(10) Only device manufactured that gives positive full time protection.

Frequency ranges available include 24-54 megacycles, 72-76 megacycles, 144-174 megacycles, 450-470 megacycles.

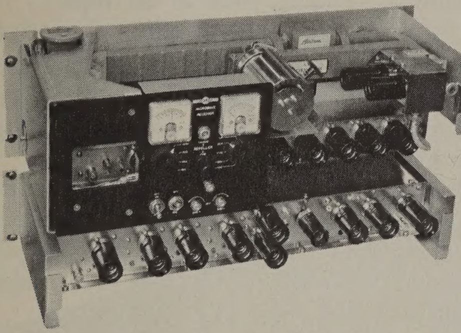


Sonar Model 30

SONAR RADIO CORPORATION, 3050 West 21st Street, Brooklyn 24, New York has been active during the past summer months introducing a new 35 watt transistorized marine radio telephone. The Sonar Model 30 is FCC type accepted of course, features 6 marine channels and the broadcast band with front panel tuning, antenna current indicator, and receiver r.f. sensitivity control. Class B high level modulation is also featured, with quick detach plug in power cable and a provision for remote control. In keeping with the salt air environment most Marine Radiotelephones are operated in, the unit is rugged all aluminum non-magnetic construction and treated against the effects of salt water and fungus. Model 30 from Sonar sells for $299.95 complete with three pair of crystals and microphone.

COLLINS RADIO COMPANY, P. O. Box 1891, Dallas 21, Texas is showing a new line of microwave transmitters operational in the 6 to 8 kmc. and 11 to 15 kmc. bands. Transmitter power outputs of 100 milliwatts and I watt are available in the 6 to 8 kmc range and 50 and 500 milliwatts in the 11 to 15 kmc range. The new systems are designed especially for wide band data

transmission high density communication systems, and video relaying over long multi-hop systems.



Collins 11-15 kmc. microwave receiver

Other features of the Collins microwave line include transmitter AFC and d.c. power supply operation.

MOTOROLA is sporting a new line of folded coaxial design base station antennas for 136-174 megacycle two-way systems. Three antenna series are included . . omni-directional (TAD 6070), cardioid (TAD 6080) and unidirectional (TAD 6090).

New Motorola TAD Type Antenna

All three basic antennas utilize a center fed half-wave design with a folded radiating element and a coaxial skirt section. This design eliminates projecting ground plane rods to simplify installation, reduce pattern distortion and minimize ice damage in cold climates. Parasitic elements are used to provide specialized radiation patterns in the cardioid and unidirectional series. Forward gain in the direction of maximum signal strength for the cardioid series is 3 db and 5.8 db for the unidirectional models over standard center fed half-wave antenna. All antennas maintain a VSWR of 1.5 : 1 across their rated frequency bands, have a nominal impedance of 50 ohms and can be used with base stations up to 500 watts r.f. power.

DECIBEL PRODUCTS, INC., P. O. Box 10764, Dallas 7, Texas, manufacturer of antennas and transmission lines, announces a new station antenna for use in the 450 to 470 megacycle band.

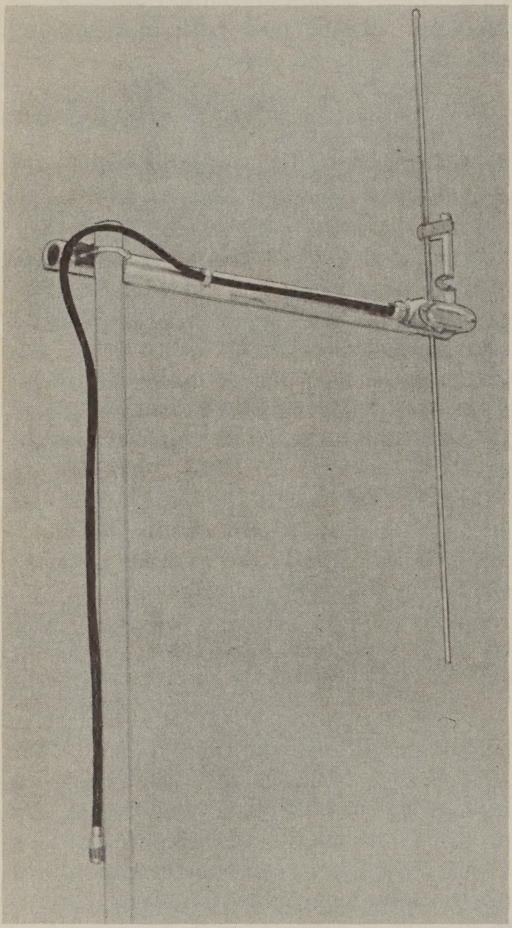
Designated the DB-406, the antenna uses newly designed dipole elements to provide either a 7.4 db gain in a circular pattern, of 12.2 db gain in a directional pattern. This is the first commercially available high gain antenna to cover the entire 450-470 megacycle band without adjustment.

The DB-406 weighs 10 pounds, is 12 feet long, and is guaranteed to withstand winds to 125 miles per hour. Full details are available from the manufacturer.

HOWARD W. SAMS & Company, 1720 East 38th Street, Indianapolis 6, Indiana has published a new two-way servicing and installation book for the technician and/or engineer in the field. Titled "Two-Way Radio Maintenance" the book was written by Jack Darr, a well versed sort in the field of two-way communications. Charts, installation and tune-up procedures, tips on locating troubles . . all are covered in 9 chapters encompassing 256 pages. The price is $4.95 and the book may be ordered direct from SAMS or purchased at most wholesale supply houses.

BRAD THOMPSON INDUSTRIES, INC. of 83-810 Tamarisk Street, Indio, California has announced the acquisition of rights to build and sell GIBSON Antennas. The purchase was made from Bill Gibson of Salem, Oregon.

Among the first antennas to be produced under the agreement is a single element dipole for 150-170 megacycles and a 2 element stacked colinear dipole for the same frequency range. Both antennas feature solid dipole elements, gamma match to 50 ohm lines, and better than 1.2 to 1 VSWR. All antennas in the line are designed for exceedingly rugged applications where moutain top winds often exceed 100 miles per hour and icing conditions are at their severest.



Gibson Ruggedized Dipole Antenna

BRAD THOMPSON INDUSTRIES is establishing a remote antenna testing and proving ground site on a 97 acre plot in the Santa Rosa Mountains 8 miles south of Indio. Fred W. Voigt is manager of the antenna operation, coming to Brad Thompson from Hickok Electrical Company of Cleveland, Ohio.

Full data sheets are available from the company in Indio.

VERSA-TRONICS of Box 223, Wheeling, Illinois, has announced a new line of mobile antennas with a magnetic base for positioning on top of a vehicle. According to the manufacturer the new VERSA-TENNA requires no mounting holes and is held in place on "any reasonably flat magnetic surfaces, such as car tops."

The antenna is available in the 450-470 megacycle range (overall height-6 inches) and the 150-160 meagcycle range (overall height-18 inches). Other frequency ranges are available on order.

The antenna is reported by the manufacturer to be secure at high vehicular speeds, 50 ohm impedance, and it comes supplied with 12 feet of RG58U cable or an equal.

Prices range from $4.95 up.

THE ANDREW CORPORATION, P. O. Box 807, Chicago, Ill., has released a new Flexible Coaxial Cable Catalog tabbed "Catalog H." The catalog contains a comprehensive listing of HELIAX, the flexible airdielectric cable introduced by the company in 1952.

NOTICE: Firms desiring product release space within these pages are advised to direct material to "New Products, Horizons Publications, P.O. Box 3207, Modesto, California."

Miner Is Major Force

(Continued from page 24)

He attended the University of Missouri and has an electrical engineering degree from Purdue University. Jack holds membership in the Insitute of Radio Engineers and has served on several of that organization's committees.

The decision to specialize in two-way radio servicing was an easy one—and one that has proved profitable and stable. One of the first steps was to qualify for acceptance as a Motorola Service Station. Both Miner and Motorola have benefitted from the relationship for eight years.

THREE SY-PEP PAPERS

are in this issue
of Communication Horizons.
Have you submitted your SY-PEP
paper yet? See page
one for full details.

NEXT MONTH

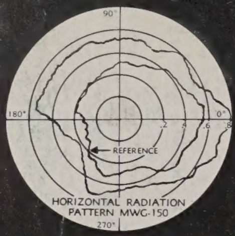
SY-PEP PAPER
Multi Transmitter Receiver Installations
Problems and Cures

SY-PEP PAPER
The Care and Feeding of Teflon Parts

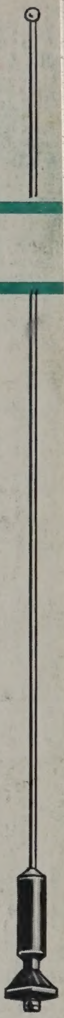
SPECIAL REPORT
A Brand New 450-470 Mc/s Repeater

INDUSTRY REPORT
Rio Grande Railroad Microwave System

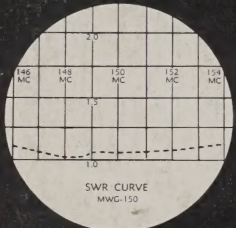
PLUS . . .
"Our Man in Washington"
Product Showcase
Public Safety Communications
and several features now in preparation



HORIZONTAL RADIATION PATTERN MWG-150



150 MC MOBILE ANTENNA SYSTEMS

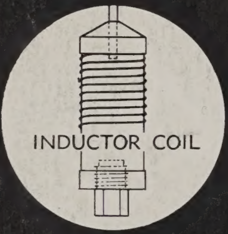


SWR CURVE MWG-150

3.0DB GAIN 5/8 WAVE MOBILE WHIP

The Model MWG-150 is an extended 5/8 wave length mobile whip which develops 3.0db omni-directional gain. It is complete with a molded styron base assembly and solderless connector for RG-58/U coaxial cable. The weather-proof positive roof top base installs quickly and easily from outside of the vehicle through a single hole. The tapered stainless steel whip is extremely flexible and requires the use of Model No. MWGS miniature spring only to facilitate low overhead clearance and garaging. The 1/8 wave length matching inductor is hermetically sealed. All hardware is chromium plated steel. The antenna is also available without roof top mount for use with an adapter to replace existing quarter-wave length vehicular antenna installations. (Model No. RWG-150). Model No. RWGM adaper adapts Motorola TU316 roof top mount to Hy-Gain RWG-150. Model RWG-G adapts GE or RCA roof top mounts to Hy-Gain RWG-150.

16'


INDUCTOR COIL

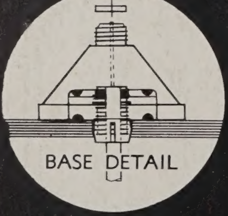
MECHANICAL SPECIFICATIONS

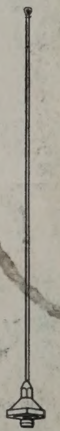
Mounting hole diameter	7/16"
Radiator Material	17-7PH Stainless Steel
Radiator Diameter	Base .120" Tip .060"
Radiator Length	Approximately 52"
Net Weight	7 Oz.

ELECTRICAL SPECIFICATIONS

Maximum Power	150 Watts
Omni-directional gain	3.0db
Vertical Beam Width (at 50% Power)	30 degrees
Nominal Impedance	50 ohms
VSWR at Resonance	1.05 to 1
Band Width for 1.5 to 1 VSWR	Plus or Minus 10%
Frequency Range (Adjustable)	144 to 174mc

(Available on specific frequency in the 108 to 144mc range)


BASE DETAIL



UNITY GAIN 1/4 WAVE MOBILE WHIP

The Model MW-150 is a commercial duty quarter-wave length mobile whip which is complete with a molded styron roof top base assembly and solderless connector RG-58/U coaxial cable. Model No. RW-150 stainless steel whip without mount is separately available for easy replacement.

MECHANICAL SPECIFICATIONS

Mounting hole diameter	7/16"
Radiator Material	17-7PH Stainless Steel
Radiator Diameter	.040"
Radiator Length	Approximately 16"
Weight	3 Oz.

ELECTRICAL SPECIFICATIONS

Maximum Power	250 Watts
Nominal Impedance	50 ohms
VSWR at resonance	1.1 to 1
Band Width for 1.5 to 1 SWR	Plus or Minus 10%
Frequency Range (Adjustable)	144 to 500mc

(Available on specific frequency in the 108 to 144mc range)

hy-gain

antenna products 1135 No. 22nd St. Lincoln, Nebraska